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10/534,159	05/05/2005	Jens-Peter Schlomka	PHDE020257US	9967

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Philips Intellectual Property & Standards
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EXAMINER	
HO, ALLEN C	

ART UNIT	PAPER NUMBER
2882	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)
	10/534,159	SCHLOMKA ET AL.
	Examiner	**Art Unit**
	Allen C. Ho	2882

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,5-7,9-14 and 16-19* is/are rejected.

7)☒ Claim(s) *3,4,8,15 and 20* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *12 February 2008* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 6, 7, 9-11, and 16-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Harding *et al*. (U. S. Pub. No. 2002/0150202 A1) in view of Schneider *et al*. (Medical Imaging 2001).

With regard to claim 1, Harding *et al*. disclosed a computed tomography method that comprises the steps of: a) generating, using a radiation source (S) and a diaphragm arrangement (**31**) which is arranged between an examination zone (**13**) and the radiation source, a fan beam (**42**) traverses the examination zone and an object present therein; b) generating relative motions, comprising a rotation about an axis (**14**) of rotation, between the radiation source and the object (paragraph [0022]); and c) acquiring measuring values which are dependent on the intensity of the radiation by means of a detector unit (D) which detects, during the relative motions, the primary radiation from the fan beam and radiation which is coherently scattered in the examination zone or on the object (paragraph [0032]).

However, Harding *et al*. failed to disclose the step of: d) reconstructing a CT image of the examination zone from the measuring values, during which back projection is carried out in a

volume which is defined by two linearly independent vectors of the rotational plane and a wave vector transfer.

Schneider *et al*. disclosed a computed tomography method that comprises reconstructing a CT image of an examination zone from the measuring values, during which reconstruction is carried out in a volume which is defined by two linearly independent vectors (x, y) of the rotational plane and a wave vector transfer (q). Although Schneider *et al*. proceeded with iterative algebraic reconstruction technique (ART), Schneider *et al*. clearly indicated that filtered back projection is a viable alternative to iterative algebraic reconstruction technique (ART) (p. 756, 3.1 The Reconstruction Algorithm - Principles and Degradation Effects, first paragraph).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to reconstruct a CT image of the examination zone from the measuring values, during which back projection is carried out in a volume which is defined by two linearly independent vectors (u, v) of the rotational plane and a wave vector transfer (q), since a person would be motivated to visually identify anomalous regions that coherently scattered x-rays.

With regard to claim 6, Harding *et al*. disclosed a computed tomography that comprises: a radiation source (S); a diaphragm arrangement (**31**), which is arranged between an examination zone (**13**) and the radiation source, to generate a fan beam (**42**) which traverses the examination zone; a detector unit (D), which is coupled to the radiation source and comprises a measuring surface; a drive arrangement (**5**) for displacing an object present in the examination zone with respect to the radiation source alone an axis of rotation and/or parallel to the axis of rotation; a reconstruction unit (**10**) for reconstructing the distribution of the scatter intensity with the examination zone from measuring values acquired by the detector unit; and a control unit (**7**) for

controlling the radiation source, the detector unit, the drive arrangement, and the reconstruction unit in conformity with the steps a) to c) of claim 1.

However, Harding *et al*. failed to disclose the a control unit that is configured for: d) reconstructing a CT image of the examination zone from the measuring values, during which back projection is carried out in a volume which is defined by two linearly independent vectors of the rotational plane and a wave vector transfer.

Schneider *et al*. disclosed a computed tomography method that comprises reconstructing a CT image of an examination zone from the measuring values, during which reconstruction is carried out in a volume which is defined by two linearly independent vectors (x, y) of the rotational plane and a wave vector transfer (q). Although Schneider *et al*. proceeded with iterative algebraic reconstruction technique (ART), Schneider *et al*. clearly indicated that filtered back projection is a viable alternative to iterative algebraic reconstruction technique (ART) (p. 756, 3.1 The Reconstruction Algorithm - Principles and Degradation Effects, first paragraph).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to configure the control unit to reconstruct a CT image of the examination zone from the measuring values, during which back projection is carried out in a volume which is defined by two linearly independent vectors (u, v) of the rotational plane and a wave vector transfer (q), since a person would be motivated to visually identify anomalous regions that coherently scattered x-rays.

With regard to claim 7, Harding *et al*. and Schneider *et al*. disclosed the computed tomography method as claimed in claim 1. However, Harding *et al*. and Schneider *et al*. failed to disclose a computer readable medium that contains instructions for controlling a control unit

for controlling a radiation source, a diaphragm arrangement, a detector unit, a drive arrangement, and a reconstruction unit of a computer tomograph so as to carry out the method of claim 1.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to provide a computer readable medium that contains instructions for controlling a control unit for controlling a radiation source, a diaphragm arrangement, a detector unit, a drive arrangement, and a reconstruction unit of a computer tomograph so as to carry out the method of claim 1, since a person would be motivated to employ a computer as the control unit to implement the method of claim 1.

With regard to claim 9, Harding *et al.* and Schneider *et al.* disclosed the computed tomography method of claim 1, wherein the wave vector transfer is a function of a first distance between a detector element and a foot of the detector unit, a second distance between a scatter center and the foot of the detector unit, and an inverse wavelength of the coherently scattered radiation (paragraph [0032]). The physics is the same.

With respect to claim 10, Harding *et al.* and Schneider *et al.* disclosed the computed tomography method of claim 1. However, *et al.* and Schneider *et al.* did not disclose that the wave vector transfer is computed based on a function that does not include a scatter angle.

Schneider *et al.* disclosed a wave transfer q given by Equation (2). When scatter angle θ is small, $\sin\left(\frac{\theta}{2}\right) \cong \frac{\theta}{2}$. The scatter angle θ can be replaced by the ratio of the distance subtended by the scatter angle and the distance between a scattering center and a detector.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to replace Equation (2) with an approximated equation without the scatter

angle, since a person would be motivated to convert a transcendental function to an algebraic function for easier algebraic maninpuation.

With regard to claim 11, Harding *et al*. and Schneider *et al*. disclosed the computed tomography method of claim 1, wherein the wave vector transfer is a function of $A/(2D\lambda)$, where A represents a distance between a detector element and a foot of the detector unit, D represents a distance between a scatter center and the foot of the detector unit, and λ represents the wavelength of the coherently scattered radiation (paragraph [0032]). The physics is the same.

With regard to claim 16, Harding *et al*. disclosed a computed tomography system that comprises: a detector (D) that detects primary and scatter radiation traversing an examination zone (paragraph [0032]).

However, Harding *et al*. failed to disclose a reconstructor that reconstructs measuring values indicative of the detected radiation, wherein the reconstructor back projects the measuring values in a volume as a function of a wave vector transfer that varies based on a difference between a scatter center and a foot of the detector.

Schneider *et al*. disclosed a reconstructor that reconstructs measuring values indicative of the detected radiation, wherein the reconstructor reconstructs the measuring values in a volume as a function of a wave vector transfer (q) that varies based on a difference between a scatter center and a foot of the detector (Equation 2). Although Schneider *et al*. proceeded with iterative algebraic reconstruction technique (ART), Schneider *et al*. clearly indicated that filtered back projection is a viable alternative to iterative algebraic reconstruction technique (ART) (p. 756, 3.1 The Reconstruction Algorithm - Principles and Degradation Effects, first paragraph).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to provide a reconstructor that reconstructs measuring values indicative of the detected radiation, wherein the reconstructor back projects the measuring values in a volume as a function of a wave vector transfer that varies based on a difference between a scatter center and a foot of the detector, since a person would be motivated to visually identify anomalous regions that coherently scattered x-rays.

With regard to claim 17, Harding *et al*. and Schneider *et al*. disclosed the computed tomography system of claim 16, wherein the wave vector transfer (q) is a function of $(1/\lambda)\sin(\theta/2)$, where λ is the wavelength of the scattered radiation, and θ is the scatter angle (Schneider *et al*., Equation 2).

With regard to claim 18, Harding *et al*. and Schneider *et al*. disclosed the computed tomography system of claim 17, wherein the scatter angle is a function of arctan(A/D), where A is a distance between the detector element and the foot of the detector unit, and D is a distance between the scatter center and the foot of the detector unit (This is just geometry).

With regard to claim 19, Harding *et al*. and Schneider *et al*. disclosed the computed tomography system of claim 16, wherein an intensity of the scattered radiation is dependent exclusively on the scatter material (This is just physics).

3. Claims 2 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Harding *et al*. (U. S. Pub. No. 2002/0150202 A1) and Schneider *et al*. (Medical Imaging 2001) as applied to claim 1 above, and further in view of Proska *et al*. (U. S. Patent No. 6,285,733 B1).

With regard to claim 2, Harding *et al*. and Schneider *et al*. disclosed the computed tomography method as claimed in claim 1.

However, Harding *et al.* and Schneider *et al.* failed to teach that the back projection during the reconstructing step d) is performed along rays having a curved shape.

Proska *et al.* disclosed a computed tomography method that comprises a reconstructing step including performing back projection along rays having a curved shape (column 5, line 55 - column 6, line 10). This reconstructing method features reduced amount of calculation work (column 1, lines 59-63).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to perform back projection along rays having a curved shaped as disclosed by Proska *et al.*, since a person would be motivated to reduce the calculation time of reconstruction.

With regard to claim 5, Harding *et al.* and Schneider *et al.* disclosed the computed tomography method as claimed in claim 1, wherein the reconstructing step d) comprises the following step: reconstructing the distribution (CT image) of the scatter intensity from the measuring values, during which back projection is carried out in a volume which is defined by two linearly independent vectors (u, v) of the rotational plane and a wave vector transfer (q).

However, Harding *et al.* and Schneider *et al.* failed to disclose the following reconstructing steps: one-dimensional filtering of the measuring values in the direction parallel to the rotational plane; and rebinning of the measuring values so as to form a number of groups, each measuring values measured by a detector element being associated with a line from the detector element to the radiation source position and each group comprising a plurality of planes which are parallel to one another and to the axis of rotation and in which a respective line fan is situated.

Proska *et al.* disclosed a computed tomography method that comprises the following reconstructing steps: one-dimensional filtering of measuring values in the direction parallel to the rotational plane (column 7, lines 1-14); and rebinning of the measuring values so as to form a number of groups, each measuring values measured by a detector element being associated with a line from the detector element to the radiation source position and each group comprising a plurality of planes which are parallel to one another and to the axis of rotation and in which a respective line fan is situated (column 5, line 20 - column 6, line 67). This reconstructing method features reduced amount of calculation work (column 1, lines 59-63).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to perform back projection along rays having a curved shaped as disclosed by Proska *et al.*, since a person would be motivated to reduce the calculation time of reconstruction.

4. Claims 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Harding *et al.* (U. S. Pub. No. 2002/0150202 A1) in view of Schneider *et al.* (Medical Imaging 2001) and Proska *et al.* (U. S. Patent No. 6,285,733 B1).

With regard to claim 12, Harding *et al.* disclosed a computed tomography method that comprises: generating, using a radiation source (S) and a diaphragm arrangement (**31**) arranged between an examination zone (**13**) and the radiation source, a fan beam (**42**) traverses the examination zone; generating a relative motion, comprising a rotation about an axis (**14**) of rotation, of the radiation source about the examination zone and an object disposed therein (paragraph [0022]); and acquiring measuring values which are dependent on the intensity of the radiation by means of a detector unit (D) which detects, during the relative motion, the primary

radiation from the fan beam and radiation which is coherently scattered in the examination zone or on the object (paragraph [0032]).

However, Harding *et al*. failed to disclose reconstructing a CT image of the examination zone from the measuring values, during which a back projection is carried out in a volume which is defined by two linearly independent vectors of the rotational plane and a wave vector transfer, wherein the back projection is performed in the volume along rays having a curved shape.

Schneider *et al*. disclosed a computed tomography method that comprises reconstructing a CT image of an examination zone from the measuring values, during which reconstruction is carried out in a volume which is defined by two linearly independent vectors (x, y) of the rotational plane and a wave vector transfer (q). Although Schneider *et al*. proceeded with iterative algebraic reconstruction technique (ART), Schneider *et al*. clearly indicated that filtered back projection is a viable alternative to iterative algebraic reconstruction technique (ART) (p. 756, 3.1 The Reconstruction Algorithm - Principles and Degradation Effects, first paragraph).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to reconstruct a CT image of the examination zone from the measuring values, during which back projection is carried out in a volume which is defined by two linearly independent vectors (u, v) of the rotational plane and a wave vector transfer (q), since a person would be motivated to visually identify anomalous regions that coherently scattered x-rays.

Proska *et al*. disclosed a computed tomography method that comprises a reconstructing step including performing back projection along rays having a curved shape (column 5, line 55 - column 6, line 10). This reconstructing method features reduced amount of calculation work (column 1, lines 59-63).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to perform back projection along rays having a curved shaped as disclosed by Proska *et al.*, since a person would be motivated to reduce the calculation time of reconstruction.

With regard to claim 13, Harding *et al.*, Schneider *et al.*, and Proska *et al.* disclosed the computed tomography method of claim 12, wherein the curved shaped shape is a hyperbola (the shape is the same given the same wave vector transfer).

With regard to claim 14, Harding *et al.*, Schneider *et al.*, and Proska *et al.* disclosed the computed tomography method of claim 13, wherein the hyperbola is a function of a distance between a scatter center and a foot of the detector unit (given the same wave vector transfer).

Allowable Subject Matter

5. Claims 3, 4, 8, 15, and 20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Amendment

6. Applicants' amendments filed 12 February 2008 with respect to the drawings have been fully considered. The objections of the drawings have been withdrawn.

7. Applicants' amendments filed 12 February 2008 with respect to claims 1-8, 12, 14-17, 19, and 20 have been fully considered. The objections of claims 1-8, 12, 14-17, 19, and 20 have been withdrawn.

8. Applicants' amendments filed 12 February 2008 with respect to claims 1-5 and 9-11 have been fully considered. The rejection of claims 1-5 and 9-11 under 35 U.S.C. 112, first paragraph, has been withdrawn.

9. Applicants' amendments filed 12 February 2008 with respect to claims 1-5, 8-15, and 17-20 have been fully considered. The rejection of claims 1-5, 8-15, and 17-20 under 35 U.S.C. 112, second paragraph, has been withdrawn.

Response to Arguments

10. Applicants' arguments filed 12 February 2008 have been fully considered but they are not persuasive.

With respect to the rejection of claims 1, 6, 7, 9, 11, and 16-19 under 35 U.S.C. 103(a) as being unpatentable over Harding *et al*. (U. S. Pub. No. 2002/0150202 A1) in view of Schneider *et al*. (Medical Imaging 2001), the applicants argue that Schneider *et al*. did not disclose that x and y are two linearly independent vectors of a rotational plane. The examiner respectfully disagrees. A general vector in a two-dimensional rotational plane cannot not be described by two linearly dependent vectors.

Let us suppose that x is the coordinate along an $\vec{x}$ vector and y is the coordinate along a $\vec{y}$ vector. If $\vec{x}$ and $\vec{y}$ are two linearly dependent vectors, then the definition of linearly dependent vectors requires that $a\vec{x} + b\vec{y} = \vec{0}$, or $\vec{y} = -\frac{a}{b}\vec{x}$, where a and b are non-zero scalers. A general two-dimensional vector $\vec{r}$ cannot be expressed as a linear combination of vectors $\vec{x}$ and

$\vec{y}$ because $\vec{r} \neq C\vec{x} + D\vec{y} = \left(C - \frac{Da}{b} \right) \vec{x}$ when $\vec{r}$ and $\vec{x}$ are not parallel to each other. Therefore, $\vec{x}$ and $\vec{y}$ must be two linearly independent vectors.

Accordingly, the rejections are being maintained.

Conclusion

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allen C. Ho whose telephone number is (571) 272-2491. The examiner can normally be reached on Monday - Friday from 9:00 am - 6:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward J. Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Allen C. Ho/
Primary Examiner
Art Unit 2882

22 April 2008